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ABSTRACT

Twelve children (mean age = 2 1/2 yrs.) were instructed in a group setting to follow a number of different requests by a teacher. In Experiment I, the group's instruction following behavior remained low regardless of whether (1) the teacher provided either modeling or verbal cues or a combination of these two and (2) another adult did or did not comply with the teacher's requests. Neither the adult model nor any of the children ever received explicit reinforcement in Experiment I. In Experiment II, reinforcement was first delivered to the adult demonstrator model for compliance but was never given to any of the child observers. Despite this vicarious reinforcement procedure, the group's behavior was not elevated. When explicit reinforcement was then directly delivered continuously and exclusively during selected sessions to four of the group's members, instruction following by three of these target children was elevated (and later lowered in two cases where extinction procedures pertain). However, the behavior of the remaining nontarget children in the audience remained low. Substantial improvement and maintenance of instruction following obtained in the entire group when each of the members was provided direct but intermittent reinforcement during each session. [Five pages of tabular material have been deleted from this document due to poor reproducibility.] (Author/SB)

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Abstract

Twelve children (mean age = 2½ yrs.) were instructed in a group setting to follow a number of different requests by a teacher. In Exp. I, the group's instruction following behavior remained low regardless of whether (1) the teacher provided either modeling or verbal cues or a combination of these two and (2) another adult did or did not comply with the teacher's requests. Neither the adult model nor any of the children ever received explicit reinforcement in Exp. I. In Exp. II, reinforcement was first delivered to the adult demonstrator model for compliance but was never given to any of the child observers. Despite this vicarious reinforcement procedure, the group's behavior was not elevated. When explicit reinforcement was then directly delivered continuously and exclusively during selected sessions to four of the group's members, instruction following by three of these target children was elevated (and later lowered in two cases where extinction procedures pertain). However, the behavior of the remaining nontarget children in the audience remained low. Substantial improvement and maintenance of instruction following obtained in the entire group when each of the members was provided direct but intermittent reinforcement during each session. Reinstatement of continuous and exclusive reinforcement to one of the former target children did not lower the group's high level of

performance whereas, earlier, this same vicarious reinforcement paradigm failed to establish group compliance. Next, nonpresentation of reinforcement to any of the children significantly but gradually extinguished performance over time. Performance recovered when group intermittent reinforcement conditions were reintrodcued. The importance of a history of intermittent reinforcement is emphasized for the maintenance of a functional class of behaviors in children and the ensuing instructional control developed by a supervising adult.

Effects of Direct, Intermittent, and Vicarious Reinforcement Procedures on the Development and Maintenance of Instruction Following Behaviors in a Group of Young Children[1]

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In most "vicarious-reinforcement" paradigms (Bandura, 1969; 1971), an observer is first allowed to watch a model receive positive reinforcing events for certain prescribed behaviors and then later given the freedom to perform that or any other behavior. A frequent finding is that the observer's behavior is significantly altered (compared to relevant control conditions) in the sense that it more nearly matches or is imitative of the model's actions. Since the observer, during the exposure period, is not given the opportunity to engage overtly in the recorded behavior and is deliberately not provided any explicit positive reinforcement, the above findings are sometimes used as damaging arguments to instrumental learning positions based on reinforcement.

Gewirtz (1971) has claimed that the above results only appear due to a "vicarious" - or "self-reinforcement" phenomenon because experienced subjects are typically used whose reinforcement history with respect to the discriminative cues and target behaviors in the experimental situation is largely unknown or rarely charted.

UD 013 667

For example, it is possible that stimuli emanating from the model's behavior and from the reinforcing stimuli delivered to that person could be discriminative for the observer to emit one among many members of a functional response class which was established by prior conditioning. Still further, it is possible for the response member to endure in the absence of any current explicit reinforcement mainly because the class of behavior is unknowingly being sustained by some schedule of intermittent reinforcement.

To discern whether aspects of the modeling situation are functionally related to a child-observer's past history of reinforcement with respect to the class of behavior under examination, the following inquiries seem appropriate: (1) to identify children for whom the target behaviors are initially minimal or nonexistent; (2) to discover reinforcement procedures that will reliably raise and maintain these behaviors; and (3) to change the conditions in the modeling situation that should be related to the prior conditioning procedures. Experiment I was designed to meet the first goal. The instruction following behaviors of young (two-and-one-half-year-old) children were evaluated under several conditions which featured the availability of different types of instructional cues provided by a model "teacher" and sometimes by another complying adult. Following the Experiment I findings of low levels of instruction following, Experiment II was attempted in order to elevate these levels in individual

children and the group of children as a whole by techniques that involved direct and continuous reinforcement for these behaviors presented either to an adult demonstrator-model or to several children in the group who served as models during certain sessions.

Additionally, in Experiment II a reinforcement regime was established over several sessions that intermittently reinforced the behaviors of each child in the group--a situation that likely reflects what occurs in real life settings (Gewirtz & Stingle, 1968). The use of intermittent reinforcement to increase and maintain behavior can become a theoretically intriguing issue (Gewirtz, 1971), especially if, after the installation of these procedures, all reinforcement is subsequently removed for all group members or is presented exclusively to one group member. Would the behavior of the group members persist even though explicit direct reinforcement is never available to the whole group?

Another dimension to these experiments is its potential didactic impact. Young economically deprived children were the subjects, and the nature of the instructions comprised a diverse set of functional cues and use of materials relating to their immediate environment as well as to relationships that held between objects in this environment (e.g., use of prepositional words to convey meaning). From what is known about this population of children (Deutsch, 1967; Bereiter & Engelmann, 1966), the instructions understandably initially failed to demonstrate stimulus

control over their behaviors, but the experiments did enable specification of procedures from which a fair amount of control did eventually develop. Moreover, as in other studies (Zimmerman, Zimmerman & Russell, 1969), instructional control was attempted within a real life group setting by procedures that could easily be established with individual children needing remediation.

EXPERIMENT I

METHOD

Subjects and Setting

Six boys and six girls, ranging in age from 19 to 37 months at the start of the experiment ($\bar{X}$ = 29.6 months), participated. These subjects comprised the total enrollment of the Early Childhood Day Care Center, and they had been attending the Center from 8 a.m. to 5 p.m. for about six weeks prior to initiation of the study. All were black and from welfare recipient homes. Individually administered intellectual assessments (Bayley, Stanford-Binet) placed their functioning from the Mildly Retarded to Above Average range of intelligence, though motor development in all was at least average.

Instruction following behaviors were investigated in a moderate-sized (10' X 14') dining room during the children's regular afternoon snack time. Sessions were held usually five times a week and lasted 10-15 minutes. The children occupied the

same assigned seats during the course of the study with three boys and three girls at each of two adjacent dining room tables. Positioned at the center front of the room were a table and a chair where the "teacher" sat, and off to the teacher's right was another chair where another adult, hereafter called the "demonstrator-model", sat. Both adults were thus in full view of the subjects.

Prior to the start of an experimental session, the children had already been seated and engaged in eating snacks for about five minutes. Two or three times during the experiment, the children were asked by an aide if they wished extra snacks. There requests were quickly fulfilled, and during these times the experiment was momentarily stopped.

Characteristics of Instructional Statements

To gauge how well the children would follow an adult's request to carry out relatively simple instructions, 90 different statements were constructed, all judged to be within the behavioral repertoire of the average 2½-year-old child. These judgments were made by a child psychologist, a psychometrist familiar with the culturally disadvantaged child, and a graduate student.

The instructional statements, broadly categorized, referred to a part of the body, to an object in the dining room, or to a

sound the child could make. Action verbs such as rub, tap, and stomp were employed: additionally, prepositions such as, above, around, on, and behind were incorporated into many of the instructions for complexity and educational benefit. Thus, a "body part" instruction might range from the relatively simple, "touch your nose", to the more complex, "clap your hands behind your back." Objects cited and used were room fixtures common to most homes, such as table, chair, light, and window, as in, "put your hands under your chair", or "knock on the table". Some instructions utilizing sounds were "bark like a dog", or "meow like a cat."

Statements referring to the categories just mentioned were randomly distributed across three fixed lists of thirty instructions each, and one complete list was presented during a session. Each list was presented twice in a block of six sessions.

Experimental Conditions

The children's instruction following behavior was assessed for 18 sessions under the three conditions outlined below. Neither material, social, nor any other form of explicit reinforcement was provided to any of the children whenever they directly followed the instructional cues of the teacher or those of the demonstrator-model who, by prior agreement, complied with the teacher on some sessions.

1. Type of instructional cue. Seated before the children, the teacher presented the designated list of instructional statements in one of three ways: Teacher Models - The teacher said, "Everybody (or 'boys and girls') look at me and do this" and immediately demonstrated what was to be done; Teacher Verbalizes - The teacher said, "Everybody, look at me..." and then verbalized what was to be done without offering any modeling cues; Teacher Verbalizes and Models - After having given attentional and verbal cues, the teacher modeled the desired performance. These three conditions, in effect, provided the children with different kinds and amounts of information to cue instruction following behaviors. The 18 sessions were divided into three blocks of six sessions, with each block containing the three types of instructional cues presented twice in a randomized order.

2. Task of demonstrator-model. During one-half of the number of sessions devoted to each of the three types of instructional cues, the demonstrator-model, the person sitting to the right of the teacher, immediately complied with all 30 of the teacher's requests; during the remaining sessions, the model did not comply and sat motionless with a bland facial expression.[2] Additionally the teacher never administered any social or tangible rewards whenever the model followed instructions. Three females, on a random basis, assumed the role of the model.

3. Person administering instructions. On eight of the 18 sessions a black female, who was a familiar teacher-aide at the Center, assumed the role of teacher in the experiment. During seven and three sessions, respectively, two white female graduate students, who were initially unfamiliar to the children, alternated as teacher.

Recording and Reliability

Thirty instructions (trials) were presented each session. After the teacher finished giving the designated instructional cue (or after the model complied), the children had approximately five seconds to respond in order for a correct response to be counted. An intertrial interval of approximately six seconds elapsed before the teacher presented a new instruction (trial).

At least one observer was assigned to each table to record each child's response on each trial. When two independent observers per table were available, they scored for interobserver agreement, which was computed as follows: Proportion of agreement = A/A+D, where A is the total number of times the two observers agreed that a correct response had or had not occurred on a trial and D is the total number of times one observer scored a response as occurring on a trial whereas the other did not. Interobserver reliability was scored for five sessions, with the resulting average values per table being .99, .89, .94, and .98.

If less than eight children were present, the session for that day was cancelled, though during Experiment I, at least nine children were always present. Since daily attendance fluctuated, to derive a group score for the percentage of correct instruction following responses per sessions, the following formula was used:

$$\text{Percent Correct Group Responses} = \frac{1}{30} \times \frac{(\text{total number correct responses})}{(\text{number of children present})} \times 100$$

RESULTS

Group responding averaged over all 18 sessions was 9.5% correct responses per session which means that, of the 30 instructions the teacher issued each session, each child carried out, on the average, 2.85 of them. Intersession compliance for the group ranged from a low of less than 1% to a high of 26%.

Figure 1 breaks down the mean percent of the group's correct instruction following behavior as a function of the three types of instructions and whether or not, for each type, the demonstrator-model complied. Not considering the impact of the model, the

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Insert Figure 1 about here

Teacher Models condition evoked the lowest group compliance, an average of 6.6% compared to an average of 11.9% for Teacher Verbalizes and 10.1% for Teacher Verbalizes and Models. A repeated measures analysis of variance yielded a significant effect

attributable to the type of teacher instruction ($F = 4.04$, $df = 2,22$, $p < .05$). Selected *a priori* comparisons (*t* tests) indicated that the Teacher Verbalizes and Models condition evoked significantly more responding than the Teacher Models condition ($p < .05$) but, was not different from the Teacher Verbalizes condition ($p > .05$). The difference between the Teacher Verbalizes and Teacher Models conditions was also reliable ($p < .05$).

When the group of children could watch the demonstrator-model consistently follow the teacher's instructions, the group's average rate was 10.3% compared to an average of 8.7% when the demonstrator-model did not follow the teacher's instructions. This difference was not significant ($F = 1.74$, $df = 1,11$, $p < .25$). The interaction between the type of teacher instruction and compliance by the demonstrator-model was not significant ($F < 1$).

Regarding the third experimental condition, the person serving as teacher, the mean group compliance to the black person was 9.2% compared to 12.9 and 6.5%, respectively, for the two white teachers, differences which were not reliable ($F < 1$).

The analysis further substantiated broad intersubject differences in correct responding ($F = 7.56$, $df = 11,22$, $p < .001$). Four low compliers averaged less than two out of 30 correct responses each per session while the highest complier averaged less than eight.

To evaluate changes in behavior as a result of a variable associated with time, the sessions were divided into three blocks of six, with the respective levels of correct responding for each block being 3.4%, 13.5%, and 11.7%. A repeated measures analysis of variance showed a significant blocks effect ($F = 5.80$, $df = 2,22$, $p < .01$). While responding for the first block was significantly less than both the second and third blocks (both p's $< .025$), the second and third blocks did not differ significantly from each other ($p < .10$).

DISCUSSION

Despite the absence of any direct information on the extent of group instruction following behaviors of 2½-year-old children from poverty level backgrounds, the group's overall performance of less than 10% does seem rather low. Judging indirectly from what has been discovered about slightly older disadvantaged children (Bereiter and Engelmann, 1966), it is probably the case that a diversified and durable class of imitative and instruction following behaviors had not yet become functional for these subjects. This possibility of a limited repertoire to the instructional cues of an adult (Black, 1965) may account for the poor control regardless of whether a teacher's role was initially assumed by a familiar black female or either of two unfamiliar white females.

Given the redundancy of relevant cues for instruction following in the Teacher Verbalizes and Models condition, it cannot be said that this condition lacked the necessary information for compliance. Yet, the group acquiesced less than 12% of the time under this condition. Even the Teacher Models condition, particularly when the demonstrator-model complied, provided reliable information; yet group instruction following (Fig. 1) was also meager here (8%) and not appreciably greater than when the demonstrator-model failed to comply (5%).

Concerning the attentional demands of the instructional conditions, it could be argued that for the Teacher Models condition, eating and associated snack activities would seriously detract from paying close and sustained visual attention to the imitative cues of the teacher (and the demonstrator-model). Furthermore, the common verbal component in the other two conditions, which required only listening skills, would compete minimally with eating. Although statistically speaking, the Teacher Models condition was relatively inferior to the other two conditions, thus appearing to provide support for these contentions, on an absolute basis the three conditions engendered a modicum of group compliance, and there was little difference among them.

Having an adult sit before the group and request certain actions from its members during snack time does, at first glance, seem a strange situation and one perhaps not highly discriminative

for instruction following behaviors. The extremely suppressed performances during the initial block of six sessions could be accounted for by the relative unfamiliarity or unusualness of the situation. However, by the second and certainly the third block, any effects due to unfamiliarity should have been overcome. Worth emphasizing is that the children were accustomed to this didactic snack period so that its "oddness" may reside more in the eyes of a sophisticated adult and not necessarily the children's.

Unlike most studies employing a demonstrator-model, in Experiment I this individual was not explicitly reinforced for compliance, which in turn may have affected the group's performance. Bandura (1965) has asserted that the contingent delivery of positive consequences for a model's behavior will strengthen covert observational responses in an audience to a greater extent during the "vicarious reinforcement" condition than during a nonrewarded model condition. Additionally, when placed in a situation to evaluate imitative or conformity behaviors the audience should perform more like the vicariously-rewarded model than the nonrewarded model (Bandura, 1969; Liebert and Fernandez, 1970a). Experiment II was designed to assess this proposition by comparing the incidence of instruction following behavior both when the adult demonstrator-model was reinforced positively and nonreinforced for compliance.

Not all individuals will be equally effective exemplars even if certain of their behaviors are positively reinforced in the presence of a watchful audience. Bandura (1969) has summarized some of the large number of attributes of adult models that have been associated with imitative effectiveness, such as age, sex, esteem, social power, all of which are probably correlated with differential probabilities and histories of reinforcement. Hartup (1970) has done the same with children serving as demonstrator-models, concluding that reinforcement variables play a potent role in determining peer model effectiveness. Experiment II was designed partially to test the efficacy of an adult vs a variety of peer exemplars, comparisons not investigated in the reviews of vicarious reinforcement by Bandura and Hartup. More important than any child-adult comparisons within a group setting are the dynamic interactions that can take place between vicarious and direct reinforcement. When a group member's behavior is singled out for reinforcement, that child is said to be directly reinforced (Liebert and Fernandez, 1970b). Each time this occurs, there is the possibility for the remaining group members, when they exhibit the same behaviors, to be "vicariously-reinforced" since they are able to witness the reinforcement transaction administered to the peer exemplar. Moreover, when direct reinforcement is now focused on a new peer model, the former complier's behavior, even though susceptible to extinction operations, might be similarly sustained through vicarious reinforcement processes.

EXPERIMENT II

METHOD

Subjects and Setting

The same 12 children employed in Experiment I participated in Experiment II. Experimental sessions were conducted, as before, in the Center's dining room. Seventy-three percent of the sessions were conducted once a day during snack time, 9% once a day during breakfast, and 18% twice a day both during breakfast and snack time. During the times reinforcement procedures were implemented (see below), session length increased by five minutes.

Instructional Statements

The original three lists of thirty instructional statements were presented, one list per session. The order of presentation was randomized within blocks of 12 sessions so that each list appeared four times within each block.

Experimental Conditions

The Teacher Verbalizes and Models condition was used throughout Experiment II. As usual, the teacher sat behind her table at the front of the dining room. She first cued attention by saying, "Everybody (or 'boys and girls') look up here (or 'watch me')" which was followed both by a verbal statement of what was to be done and a motor demonstration of how it was to be done.

As in Experiment I, different people served as teacher. This role was taken either by a black person employed as a full-time teacher at the Center (39% of the sessions), by the second author, a white graduate student (47%), or by one of three other females (two black, one white) familiar to the children (14%).

Experimental Procedures

In investigating the conditions necessary for the acquisition and maintenance of group instruction following behavior six procedures were employed in the following order:

1. Reinforcement and nonreinforcement to the adult demonstrator-model. The adult demonstrator-model available in Experiment I always performed each of the 30 instructional statements presented by the teacher during each session. During the first 12 sessions, the teacher immediately rewarded each compliant act of the demonstrator-model with social praise and a trinket (Birmingham Vending Company, Birmingham, Alabama). Specifically, the teacher took one trinket from a tray on her table, handed it to the nearby model, while at the same time smiling and saying, "Good, you did it. Here's a prize." The demonstrator-model smiled back at the teacher, briefly held the trinket in full view of the children, smiled broadly and then dropped the trinket into a glass quart jar on her table. The children received no tangible or social reinforcement for their own compliance during this procedure. Next, four sessions of "vicarious extinction" were presented whereby the adult

model did not receive trinket and praise for her compliance. Following the last extinction session, the adult demonstrator-model was no longer used in the study.

2. Reinforcement to individual children. Glass baby food jars were glued in front of each child's place at the dining table. The lids had holes cut in their center to admit trinkets and to prohibit removal or manipulation of the trinket by the child once deposited. (At the end of a session, after the children had left, any accumulated trinkets were removed, and the bank-type tops were replaced with regular lids until the next session.)

On designated sessions, one of four children was selected to receive exclusive reinforcement for following the instructions of the teacher. Whenever the target child performed correctly, a research assistant, who stood near the teacher's desk and carried a tray of trinkets, quickly walked to his side, bent down to his eye level, and exclaimed, "Good (name of child), you did it! You won this prize." The assistant allowed the child to admire the trinket momentarily, them prompted or, if necessary, helped him drop it into the jar. This reinforcing episode lasted from 3-8 seconds, depending on how quickly the child relinquished the trinket, and was continuously accompanied by smiles and nods of approval from the assistant.

Table 1 identifies some of the developmental and behavioral characteristics of the four target children.

Insert Table 1 about here

Thus, S1, the first child to serve as the peer model was the second oldest of six boys and, during sessions 19-34 (when the adult model received vicarious reinforcement and extinction), complied 10 percent of the time. This percentage ranked him sixth highest in the group for correct instruction following. S1 received direct reinforcement for eight sessions, after which S2, the fourth highest complier, received exclusive reinforcement for five sessions and so on. Altogether, 29 sessions of this procedure were administered (from sessions 35 to 63).

S1 and S3 sat next to each other at one table, while S2 and S4 sat next to each other at the other table. Selection of peer exemplars was based on the following: the child's 1) attendance for the last 16 sessions was 80% or better; 2) playground behaviors typically involved socialization with other children and 3) behavioral ranking in the group in terms of correct instruction following during the last 16 sessions was between first and sixth.

3. Intermittent reinforcement to group members. A compliance score was derived for each child, which for the first session of this procedure, was based on the average number of times the child followed the teacher's instructions over the last 20 sessions (sessions 44 to 63). On all subsequent sessions, compliance scores for each child were based on the subject's performance during the

previous session. Prior to each session, the 12 subjects were divided into three subgroups, matched on the basis of past compliance scores: that is, each subgroup always had one low and one high complier and, depending upon attendance, one or two intermediate compliers. The composition of the subgroup members changed from session to session owing to absence of some members, and to marked shifts in the performance of some subgroup members.

During every session, on a randomly selected 10 out of 30 trials, only members belonging to one subgroup were eligible to receive trinket and social reinforcement; that is, each of the three subgroups qualified on one-third of the trials. When a particular subgroup became eligible, highest priority for reinforcement was always assigned to the lowest ranked complier and, if that child failed to follow the teacher's instructions, priority immediately shifted within that trial to the second lowest ranked complier and so on. If none of the target subgroup members performed correctly on a designated trial, then reinforcement was not presented at all. Reinforcement priority never shifted to a member of a different subgroup on a particular trial.

The schedule on which the children received reinforcement for following instructions over an entire session was clearly an intermittent one, with the maximal number of reinforcements possible for a given child being ten; and, that situation occurred when the child both: 1) followed the teacher's instructions within five

seconds on each of the ten scheduled trials reserved for his subgroup and 2) was the lowest ranked complier (or always became eligible for reinforcement because the child ranked immediately below him failed to comply). Nine sessions were devoted to the intermittent delivery of reinforcement to group members.

4. Reinstatement of reinforcement to S1. For eight sessions, only S1 was directly reinforced for following the teacher's instructions by the procedures specified in step 2.

5. Nonreinforcement of compliance for all group members. The teacher continued in her instructional routine and the assistant handling the tray of trinkets remained present, though no child was ever reinforced for instruction following. Extinction lasted for 19 sessions and, during this time, all the adults in the room maintained pleasant facial expresssons, but avoided making direct eye contact with the children or the giving of social approval for instruction following.

6. Reinstatement of intermittent reinforcement to group members. The procedures described previously in step 3 were reintroduced for eight sessions.

RESULTS

Effect of contingent reinforcement to the demonstrator-model. Figure 2 presents the percent group compliance when the group was exposed to the always-complying model whose behavior was either

reinforced or nonreinforced. The first three datum points were selected from those sessions of Experiment I when the Teacher Verbalizes and Models condition was in force and when the adult

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Insert Figure 2 about here

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model was not reinforced for instruction following. These data serve as baseline for the next two conditions which were selected from the first 16 sessions of Experiment II, when again the Teacher Verbalizes and Models condition prevailed. In the initial 12 of these 16 sessions, the model's compliance was reinforced and in the last four, it was not. Analysis of the data revealed no reliable differences between baseline, vicarious reinforcement , and no reinforcement ($F = 1.16$, $df = 2,22$), though intersubject variability was high ($F = 10.43$, $df = 10,20$, $p < .001$).

Effect of contingent reinforcement to individual subjects. Figure 3 shows the effect on group performance when the instruction following behaviors of four children were singled out for reinforcement during designated sessions. Group compliance remained low

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Insert Figure 3 about here

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relatively low when the first three children were individually reinforced, averaging from 14% to 19%. When S4 was reinforced, mean group compliance over all sessions was raised to 26%, and over the last four sessions (53-56) it was 30%. However, this group elevation

is due mainly to the cumulative achievements of the four target subjects· during this time period their average performance was 47% whereas for the eight nontarget (never reinforced) children, it was 21%.

Changes in compliance of individual children. Figure 4 depicts the individual performance changes of the four target children.

Insert Figure 4 about here

Direct reinforcement to S1 for correctly following the teacher's instructions produced a dramatic increase over the level produced when the adult model was reinforced. When reinforcement for compliance was successively shifted to the other Ss, the number of correct compliance responses by S1 appeared to be undergoing extinction.

S2's performance when the adult model was reinforced twice reached levels of 50% compliance, but fell when reinforcement shifted either to S1, S3, or to herself. When reinforcement was delivered to S4 (the girl seated next to S2) S2's compliance rose fairly steadily.

S3's compliance behavior was highest when his own performance was reinforced; when direct reinforcement shifted to S4, S3's compliance decreased gradually, again indicating possible extinction effects. S4's performance also became highest when she was reinforced for following instructions. During the last five sessions of this condition, S4 followed instructions 75% of the time.

Effect of intermittent reinforcement to group members. In the last panel of Figure 3 are presented the changes in percent group compliance when intermittent reinforcement contingencies were established for each of the group members. For the initial three sessions (64 to 66), percent group compliance was 40%, but by the last three sessions it rose to 62% (t = 5.38, p < .001). Overall, the mean group compliance during group intermittent reinforcement was 49%, compared to 26% during direct reinforcement to S4 (t = 3.21, p < .05).

Effect of reinstatement of reinforcement to S1. When reinforcement for compliance reverted to S1 exclusively, group compliance remained high, a result reflected in Figure 5. Differences between

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Insert Figure 5 about here

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group performance when reinforcement was initially given to S1 ($\bar{X}$ = 19%, see Fig. 3) and reintroduced later ($\bar{X}$ = 60%, Fig. 5) were highly reliable (t = 7.04, p < .001). Additionally, not shown is the fact that S1 himself increased in mean percent compliance during these two time segments, from 49% to 70%.

Removal and reintroduction of group intermittent reinforcement. As Fig. 5 shows, withholding reinforcement for 19 sessions, (from sessions 81 to 99) reduced group compliance only gradually; however, the mean group differences between the first five sesssions of group extinction ($\bar{X}$ = 56%) and the last five sessions ($\bar{X}$ = 41%) were significant (t = 3.29, p < .01).

Reinstatement of intermittent reinforcement contingencies to group members reversed the previous downward trend found during extinction and served to raise group compliance substantially. Although the differences between the last three extinction sessions ($\bar{X}$ = 42%) as against the first three intermittent reinforcement sessions ($\bar{X}$ = 53%) were of borderline reliability (t = 2.05, .05 < p < .10), reliable difference did emerge between the last three extinction sessions and the last three intermittent sessions ($\bar{X}$ = 64%) (t = 4.06, p < .01). The differences between the first three intermittent sessions *vs* the last three sessions were not significant (t = 1.47, .05 < p < .10).

Comparisons between the average of all extinction sessions ($\bar{X}$ = 48%) and either all sessions from the first intermittent condition ($\bar{X}$ = 49%) or all sessions from the reintroduction of intermittent reinforcement ($\bar{X}$=59%) were not reliable (both p's > .10). Additionally, the overall differences between the two intermittent conditions were not significant (p > .10).

Relationships between performance and reinforcement rate. The initial installation of the group intermittent reinforcement procedure resulted in a striking and permanent improvement in correct responding for all nontarget *S*s (*S*5 to *S*12 inclusive). For the four target *S*s, this procedure served either to raise even further the level of performance previously established by direct and continuous reinforcement, regardless of whether that level was relatively

high (as in S4), moderate (S3), or low (S2). With one subject (S1), intermittent reinforcement was associated with a small decrement in correct responding. Some of these facts are shown in Table 2.

Insert Table 2 about here

(The data for only four nontarget Ss were selected, but the same results hold if all Ss are included.) As is evident, the rate of reinforcement for three of four target Ss was much lower during the group intermittent reinforcement than during those sessions when continuous reinforcement was exclusively delivered to them. Yet, the magnitude of correct performance was generally higher during group reinforcement. For the eight, initially designated nontarget Ss, the changes in performance during group intermittent reinforcement can be concisely stated. During the first few sessions, after being reinforced from 10% to 40% of the trials that they were eligible, the instruction following behaviors of most Ss soared and was maintained by the intermittent reinforcement contingencies for the remaining sessions. The rate of acquisition varied among Ss; some became high compliers fairly immediately, causing them to receive a low rate of reinforcement upon which their performance was sustained (e.g., S5 and S6), whereas the behaviors of others continually entitled them to a moderate reinforcement rate (e.g., S7 and S8).

Focusing reinforcement entirely on S1 a second time not only served to enhance his performance, but it also served to maintain and, in some cases, to improve performance of the rest of the Ss who were now subject to extinction.

DISCUSSION

The results showed that the procedure of applying exclusive reinforcement to the adult demonstrator-model failed to raise the children's instruction following behaviors over the low levels found in Experiment I. Moreover, these same procedures when applied to the four peer exemplars were similarly unsuccessful for the group. It is difficult to claim that these failures were due to the use of inappropriate or nonreinforcing stimuli. The combination of trinket and social consequences did heighten the individual instruction following behaviors of three of the four target Ss when these consequences were made directly contingent on these performances (Figure 4). Additionally, when these consequences were no longer presented for two children (S1 and S3), these extinction operations markedly reduced the previous high incidence of instruction following generated by response contingent consequences. Also, it is not unreasonable to assume that the intermittent but direct delivery of these same consequences to individual children under the group condition played an important role in the development and maintenance of instruction following, as did the nonpresentation of these consequences in the decline of these performances during group extinction.

Worth recalling is that the children did not have the trinket banks before them both during those sessions when reinforcement was and was not delivered to the adult demonstrator-model· individualized banks first became available during the peer reinforcement procedure and remained in place thereafter. Nevertheless, despite the potential usefulness of the banks in serving as contextual cues to indicate the possible availability of reinforcement, the peer reinforcement procedures did not appreciably raise the low levels of performance left by the adult reinforcement conditions. Other factors expected to favor the peer model condition in the acquisition of performance, but evidentally did not do so, were, the greater physical proximity of group members to the reinforced model, the purported failure of disadvantaged children to perceive an adult model as directive and worthy of attention (Black, 1965), and such debatable modeling issues as the child's identity in the group and friendship relationships.

In view of the negative findings of Exps. I and II, it must be said that the procedures of having a group of young children watch an unreinforced adult perform and model a class of behaviors ("observational learning") or watch either an adult or one of their peers receive reinforcement for compliance ("vicarious reinforcement") were not effective means to establish these same behaviors in the audience. Instruction following behaviors could be effectively established in individual members of the group if direct reinforcement

were administered exclusively to target children. This method proved successful with three out of four children and, notwithstanding the failure with S2, the practice and behavioral achievements of direct reinforcement could probably have been extended to the other group members in tandem. An equally productive but less time-consuming, and a more equitable reinforcement system to raise performance consisted of the group intermittent reinforcement procedure, which for the nontarget Ss, showed that continuous (100%) reinforcement was not a prerequisite for acquisition. Whether other sources of control besides direct reinforcement to individual children existed during this procedure will be considered later.

Aside from its limited effect on behavioral acquisition, could vicarious reinforcement mechanisms provide an unequivocal and defensible account for the maintenance of behavior? The extinction data of S1 and S3 (Fig. 4) suggest that it cannot. During sessions 43 to 47, when reinforcement was scheduled for S2, S1 maintained responding at a level commensurate with acquisition despite the paucity of actual reinforcement delivered to S2, and thus the limited opportunity for S1's behavior to be sustained by "vicarious-reinforcing" consequences. Moreover, S1's behavior was subsequently lowered during sessions 49 to 63 at times when either S3 or S4 received sufficient reinforcement to have "vicariously-reinforced" S1's behavior. These same discordant findings apply to the decrement of performance by S3 during sessions 57 to 62 when the rate of rein-

forcement for S4 was increasing. It seems more justifiable and parsimonious to account for the attenuated performance of S3 and S4 as simple extinction effects.

The high and sustained group performance obtained when exclusive reinforcement was presented to S1 (Fig. 5, sessions 73 to 80) might also invoke an account couched in terms of "vicarious reinforcement". Not knowing anything about the group's past conditioning history, one might be tempted to state that by observing the delivery of reinforcers to S1 for instruction following, the group members could have been motivated to comply through the "self-reinforcement" received whenever they emitted the same behaviors as S1. However, considering the previous intermittent reinforcement history of individual Ss, this schedule's influence could perhaps more parsimoniously explain the maintenance of behavior during the extinction of all group members save S1. Gewirtz and Stingle (1968) have similarly resorted to an intermittent reinforcement mechanism in their account of the persistence of a functional class of imitative behavior by an observer in the absence of direct explicit reinforcement: and the present experiment, particularly the results from group extinction soon to be discussed, lends credence to their claims.

Aside from the long term effects of a history of intermittent reinforcement, there is the possible contribution of the reinforcing stimuli delivered to S1 acting as generalized discriminative stimuli

for each of the remaining group members to follow instructions (Gewirtz, 1971). Whereas these same reinforcing stimuli, when delivered earlier in the experiment to the four target Ss, did not evidentally cue strong instructional behaviors from the group at large, discriminative control could have developed during the group intermittent reinforcement condition.

There is, however, one major factor which tends to mitigate against strong and durable stimulus control by the reinforcing events. It should be recalled that only one reinforcer per trial was delivered to a single subject. While such a presentation mode could occasion the other group members to follow and imitate the reinforced peer's behavior, a more optimal arrangement, within the scope of operant chaining principles, would have been to reinforce three or four randomly selected Ss in succession on the same trial. Delivery of a reinforcer to any one group member could then become a distinctive informative cue and act to raise the probability that reinforcement might soon be forthcoming to someone else for correct instructional performance. This procedure of reinforcing several subjects in succession within one trial is exactly what Zimmerman, Zimmerman, and Russell (1969) did in their successful attempt to elevate instruction following behaviors of a group of retarded individuals.

There were, of course, other exteroceptive cues during the S1 condition that could function to occasion instruction following.

The trinket "banks" were in place before each child throughout each session and, prior to each trial, the tray of exposed trinkets was held by the research assistant who was employed to provide social consequences. Since these same stimuli that were correlated for reinforcement for S1 also prevailed during the previous group intermittent reinforcement conditions, it is possible that the group members failed to take note of the unavailability of reinforcement during the S1 condition. Thus, Bandura's (Bandura, 1969; Bandura and Barab, 1971) discrimination hypothesis could equally account for the group's persistence during the S1 condition.

Finally, stimulus control variables, governed by the teacher's directives, are undoubtedly important. Martin (1971) has asserted and Weisberg, Passman, and Russell (1973) have shown that weak instructional control can be reversed if the adult provides explicit contingent reinforcement; and, once instruction following reaches some high level, reinforcement can be withdrawn without an immediate deterioration in performance because the subjects have learned "to do what adults tell them to do". Similar explanations for the maintenance of behavior without explicit reinforcement have been advanced by Steinman (1970) in terms of the social control variables that induce observers to comply with an adult's nonreinforced request to "do this . . ." and by Peterson and Whitehurst (1971) in terms of subjects learning to conform to the "demand characteristics" of a situation. However, in view of the weak behavioral control

exhibited throughout Exp. I and early in Exp. II, it appears that demand characteristics and social control factors can only become operative after a functional behavioral class has first been developed.

The slow decline in instruction following during nonpresentation of reinforcement to any single child is typical of the course of extinction performance following a history of intermittent reinforcement. It is obvious that behavioral maintenance during extinction, especially during the early phases, cannot be attributed to the effects produced by vicarious reinforcement or by generalized discriminative stimuli. The extinction data also support a view which emphasizes the loss of adult instructional control when the response contingent consequences associated with the instructions are no longer applied (Ayllon & Azrin, 1964; Weisberg, Passman, & Russell, 1973). If this is so, then reinstatement of adult control can be established fairly quickly within a group setting when the consequences are again delivered, even though in this case on an intermittent basis.

A word about the sources of control over instruction following behavior during the group intermittent reinforcement procedures. To be sure, part of the control resided in the scheduling of consequences which assured that the higher frequency of reinforcement given to the low and moderate compliers was sufficient to take them through the behavioral acquisition stage, while the lower frequency

given to the high compliers was sufficient to maintain their behavior. In truth, the reinforcement regime was tailored to the behaviors of the individual children in the group and the brief time taken before each class to compose these "reinforcement lesson plans" should be well worth the effort to teachers wishing to cater to individual differences. The procedure further gave rise to the exhibition of the desired behavior on any one trial by a large number of children, each of whom could furnish modeling cues to the remaining members to follow. Frequency of competent modeling agents remains a parameter for future study.

References

Ayllon, T., and Azrin, N. H. Reinforcement and instructions with mental patients. Journal of the Experimental Analysis of Behavior, 1964, 7, 327-331.

Bandura, A. Principles of behavior modification. New York: Holt, Rinehart, & Winston, 1969.

Bandura, A. Vicarious and self-reinforcement processes. In R. Glaser (Ed.), The nature of reinforcement. Columbus, Ohio: Charles E. Merrill, 1971.

Bandura, A., and Barab, P. G. Conditions governing nonreinforced imitation. Developmental Psychology, 1971, 5, 244-255.

Bereiter, C., and Engelmann, S. Teaching disadvantaged children in the preschool. Englewood Cliffs, N.J.: Prentice-Hall, 1966.

Black, M. H. Characteristics of the culturally disadvantaged child. The reading teacher, 1965, 18, 465-470.

Deutsch, M. The disadvantaged child. New York: Basic Books, 1967.

Gewirtz, J. L. Conditional responding as a paradigm for observational, imitative learning and vicarious-reinforcement. In H. W. Reese (Ed.), Advances in child psychology and behavior, Vol. 6, New York: Academic Press, 1971, 273-304.

Gewirtz, J. L., and Stingle, K. C. The learning of generalized imitation as the basis for identification. Psychological Review, 1968, 75, 374-397.

Hartup, W. W. Peer interaction and social organization. In P. H. Mussen (Ed.), Carmichael's manual of child psychology, Vol. 2, New York: John Wiley, 1970.

Liebert, R. M., and Fernandez, L. F. Effects of vicarious consequences on imitative performance. Child Development, 1970, 41, 847-852. (a)

Liebert, R. M., and Fernandez, L. E. Imitation as a function of vicarious and direct reward. Developmental Psychology, 1970, 230-232. (b)

Martin, J. A. The control of imitative and nonimitative behaviors in severely retarded children through "generalized-instruction following". Journal of Experimental Child Psychology, 1971, 11, 390-400.

Peterson, R. F., and Whitehurst, G. J. A variable influencing the performance of generalized imitative behaviors. Journal of Applied Behavior Analysis, 1971, 4, 1-9.

Steinman, W. M. The social control of generalized imitation. Journal of Applied Behavior Analysis, 1970, 3, 159-167.

Weisberg, P., Passman, R. H., and Russell, J. E. Development of verbal control over bizarre gestures of retardates through imitative and nonimitative reinforcement procedures. Journal of Applied Behavior Analysis, 1973, in press.

Zimmerman, E. H., Zimmerman, J., and Russell, C. D. Differential effects of token reinforcement on instruction-following behavior in retarded students instructed as a group. Journal of Applied Behavior Analysis, 1969, 2, 101-112.

Footnotes

1. This study was supported in part by a contract awarded to the Early Childhood Day Care Center Project from the Alabama Department of Pensions and Security. We are grateful to Don Baucum, Aline Howard, Ruby Cox, and Annette Lloyd for their assistance.

2. Strictly speaking, the teacher also acted as a "demonstrator-model" or "model exemplar", however, these terms will be reserved to describe the function of the adult seated next to the teacher.

Table 1

Characteristics of Subjects Receiving Direct Reinforcement

Target Subject	Age-Sex	Bayley (B) MDI or Stanford Binet (S-B) IQ	Mean Percent Correct Responses (Sessions 19-34)	Relative Ranking in Group (N=12)	Number of Sessions Directly Reinforced
S1	30 mos., 2nd oldest male	B:106	10%	6	8
S2	30 mos., 3rd oldest girl	B:84	19%	4	5
S3	33 mos., 3rd oldest male	B:65	18%	5	9
S4	36 mos., 2nd oldest girl	S-B:113	46%	1	7

Table 2

Relationship between Performance and Reinforcement Rate for Several Conditions

	During Exclusive Reinforcement to Target Children			Intermittent Reinforcement to Group Members (Sessions 64-72)		Exclusive Reinforcement to S1 (Sessions 73-81)	
Subjects	Sessions	Mean Number Correct Responses	Mean Number Reinforcements (out of 30)	Mean Number Correct Responses	Mean Number Reinforcements (out of 10)	Mean Number Correct Responses	Mean Number Reinforcements (out of 30)
S1	35-42	14.7*	14.7	10.0	2.4	20.9	20.9
S2	43-47	1.2	1.2	15.2	3.6	21.1	0
S3	48-56	8.7	8.7	16.9	3.9	15.5	0
S4	57-63	17.6	17.6	21.2	1.8	21.3	0
S5	35-63	6.1	0	19.8	.9	23.0	0
S6	35-63	4.1	0	17.8	1.2	14.9	0
S7	35-63	1.6	0	12.5	3.0	16.9	0
S8	35-63	5.3	0	13.8	2.5	20.3	0

* 30 responses is the maximum number of correct instructions

Figure Legends

Fig. 1. Mean percent of group following the teacher's instructions as a function of the type of instructions presented and whether or not the demonstrator-model followed the teacher's instructions.

Fig. 2. Percent group instruction following as a function of whether the teacher administered reinforcement to the demonstrator-model for compliance.

Fig. 3. Percent group instruction following when the instruction following behavior of four target children was exclusively reinforced and when the group members were intermittently reinforced.

Fig. 4. Changes in the instruction following behavior of the four target children as a function of which child received reinforcement and whether or not the demonstrator-model was reinforced.

Fig. 5. Percent group instruction following as a function of the various reinforcement contingencies.

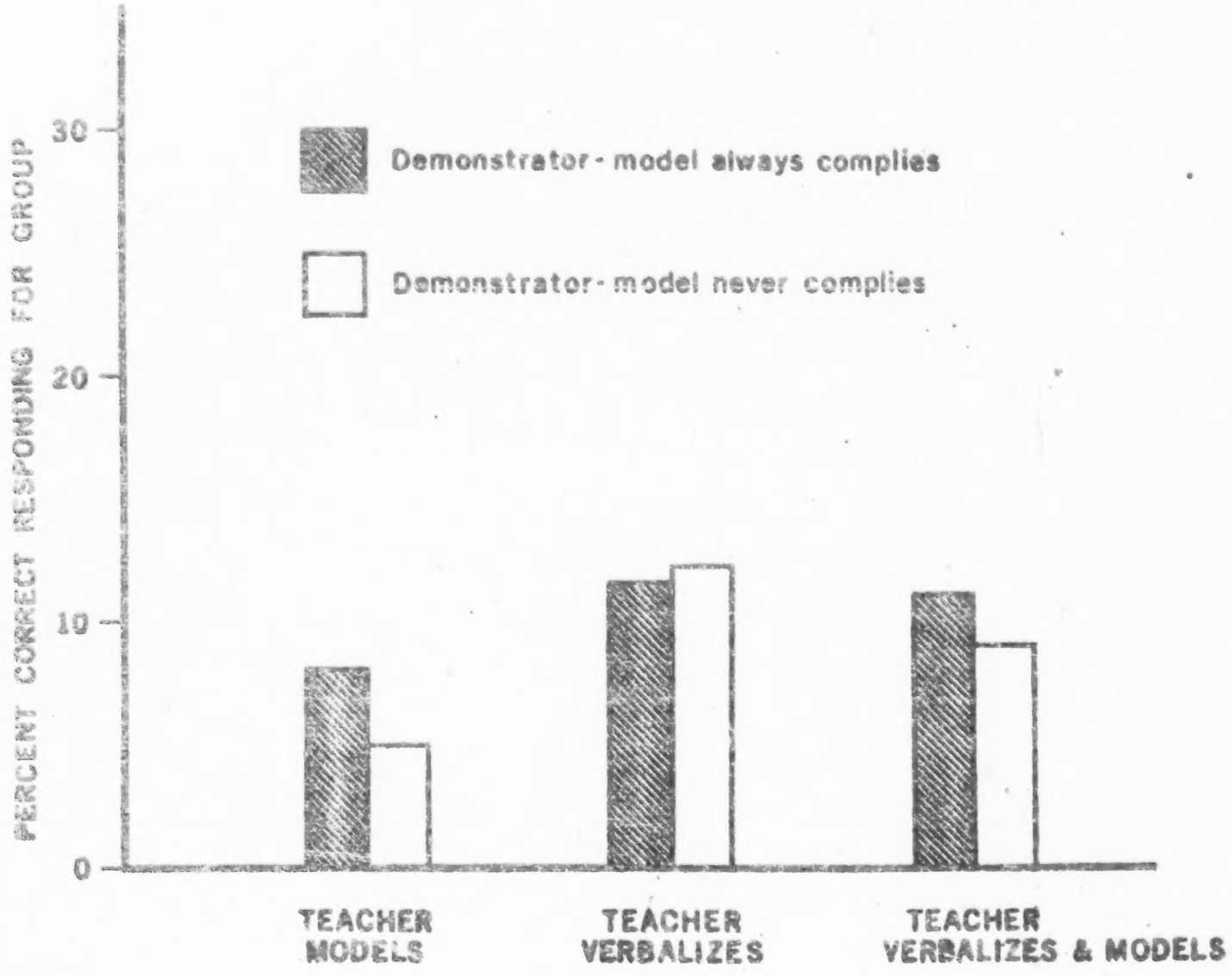
PERCENT CORRECT RESPONDING FOR GROUP
30
20
10
0
Demonstrator-model always complies
Demonstrator-model never complies
TEACHER MODELS
TEACHER VERBALIZES
TEACHER VERBALIZES & MODELS

Fig. 1

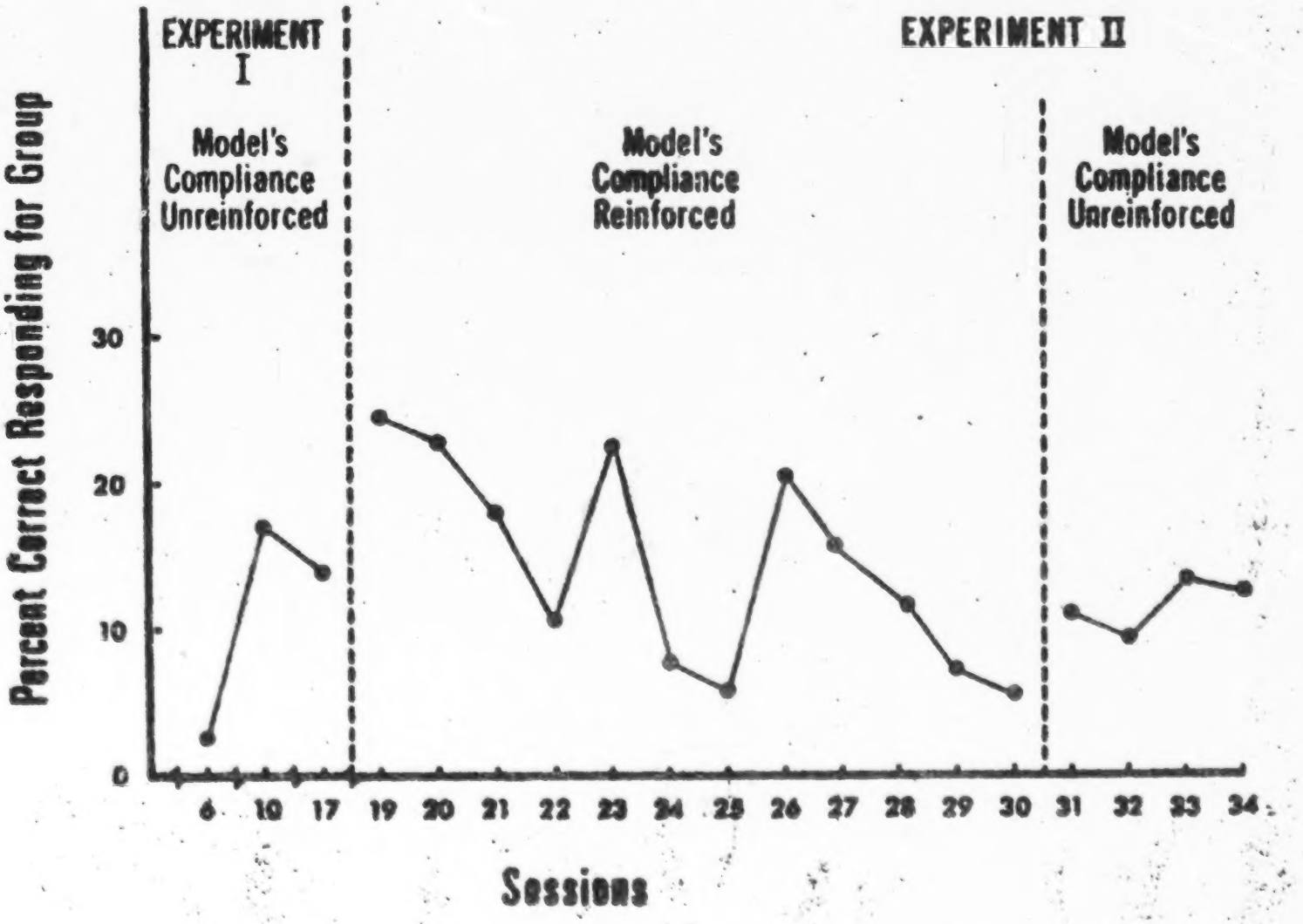
EXPERIMENT I
EXPERIMENT II
Model's Compliance Unreinforced
Model's Compliance Reinforced
Model's Compliance Unreinforced
Percent Correct Responding for Group
0
10
20
30
6
10
17
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
Sessions

Fig. 2

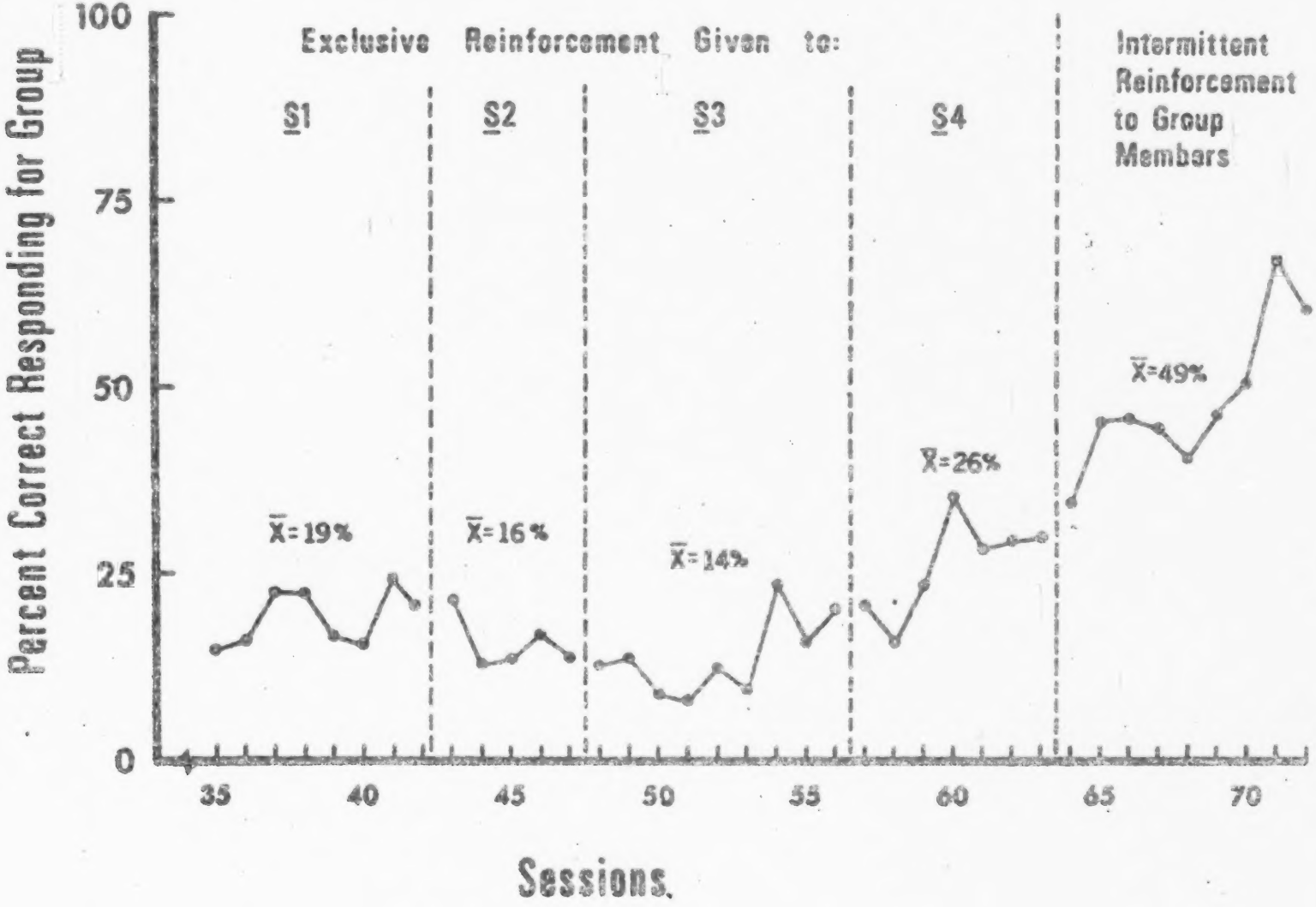
Percent Correct Responding for Group
100
75
50
25
0
Exclusive Reinforcement Given to:
S1
S2
S3
S4
Intermittent Reinforcement to Group Members
X̄=19%
X̄=16%
X̄=14%
X̄=26%
X̄=49%
35
40
45
50
55
60
65
70
Sessions.

fig. 3

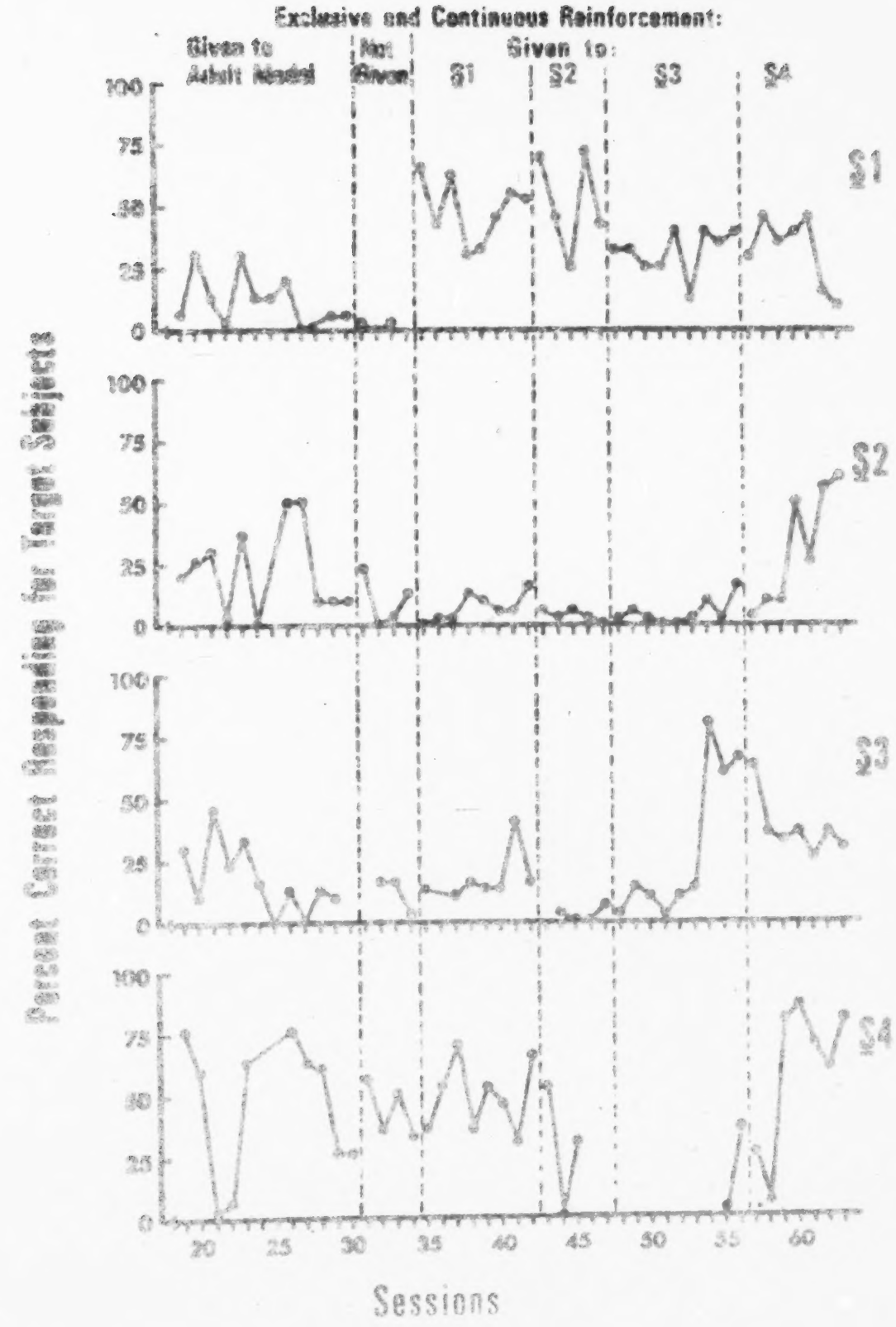
Exclusive and Continuous Reinforcement:
Given to Adult Model
Not Given
Given to:
S1
S2
S3
S4
100
75
50
25
0
S1
S2
S3
S4
Percent Correct Responding by Target Subjects
20
25
30
35
40
45
50
55
60
Sessions

Fig. 4

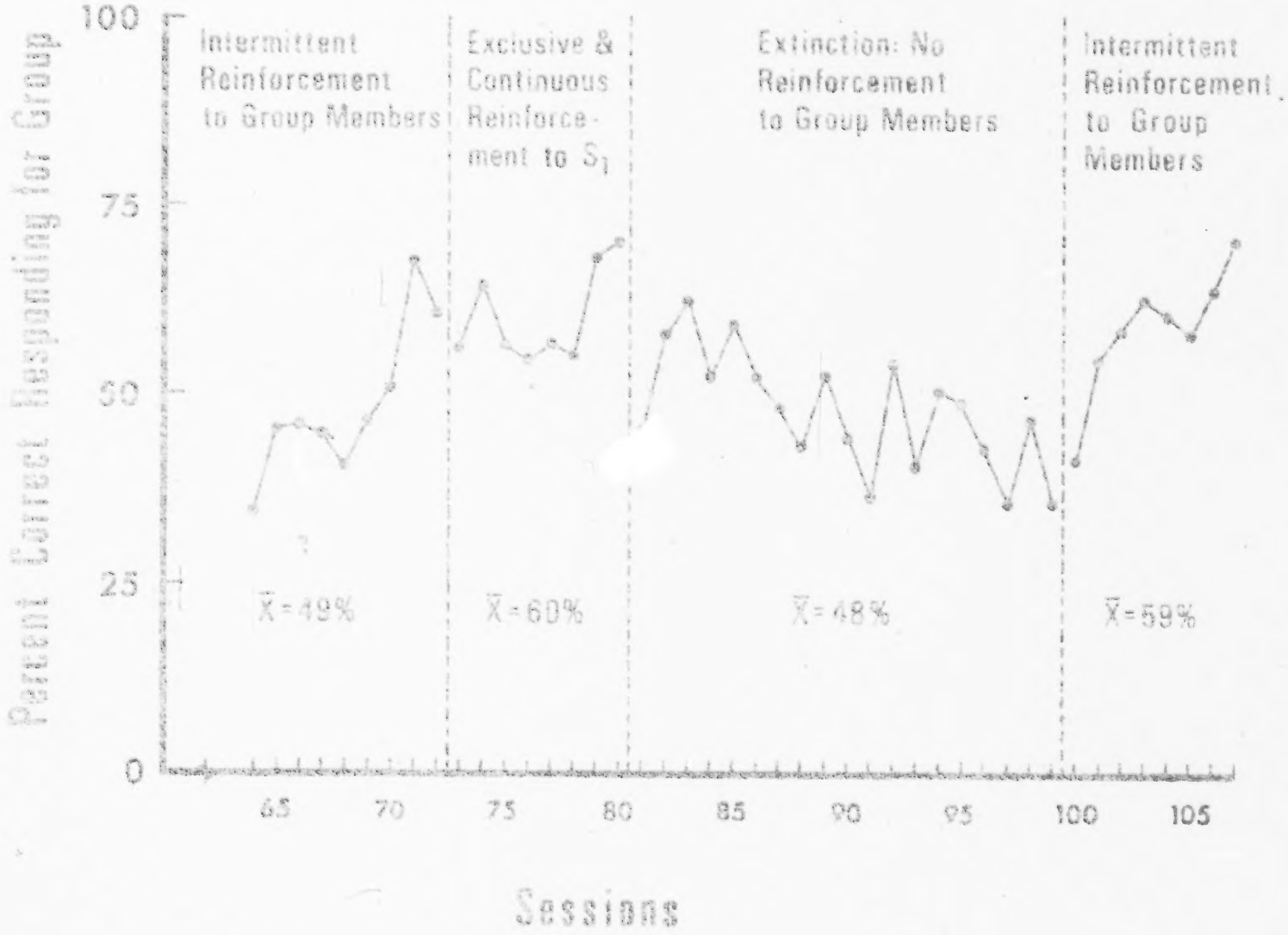
Percent Correct Responding for Group
100
75
50
25
0
Intermittent Reinforcement to Group Members
Exclusive & Continuous Reinforcement to S_1
Extinction: No Reinforcement to Group Members
Intermittent Reinforcement to Group Members
$\bar{X}$ = 49%
$\bar{X}$ = 60%
$\bar{X}$ = 48%
$\bar{X}$ = 59%
65
70
75
80
85
90
95
100
105
Sessions

Fig. 5